

Amrita School of Engineering, Bengaluru-35

23MAT106

Mathematics for Intelligent Systems – 1

Lab Practice Sheet-4

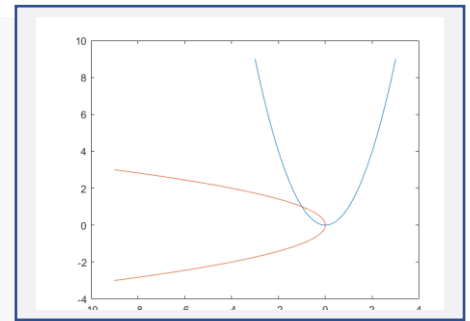
(Plots-Transformations-Reflection/Rotation, Animation Plots)

➤ Matrix transformation – Rotation/Reflection

Refer to class notes (Slide no.9) for more details of the transformation

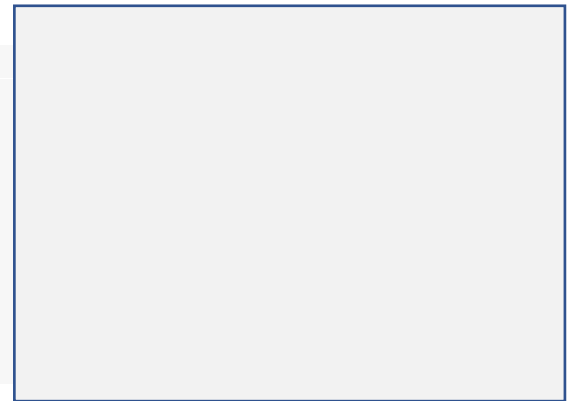
Example 1:

```
clf
t=-3:0.1:3;
x=[t;t.^2];
plot(t,t.^2)
hold on
A=[0,-1;1,0]; %rotation matrix for 90 degrees
y=A*x; %Transformation
plot(y(1,:),y(2,:))
```



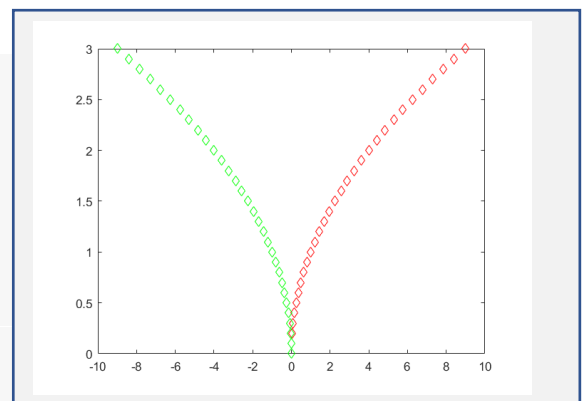
Example 2:

```
clf
t=-1:0.05:1;
x=[t;2*t];
plot(t,2*t,'m')
hold on
A=[1/sqrt(2), -1/sqrt(2);1/sqrt(2),1/sqrt(2)];
% rotation matrix for angle 45 degrees
y=A*x; % Transformation
plot(y(1,:),y(2,:), '< r')>
```



Example 3:

```
clf
t=0:0.1:3;
x=[t.^2;t];
plot(t.^2,t,'dr')
hold on
A=[-1,0;0,1]; %reflection about Y axis
y=A*x; %Transformation
plot(y(1,:),y(2,:), 'dg')
```



➤ **Animate and plot a line segment AB**

```
A=[1;1];B=[4;5];
for lamda=0:0.05:1
    x=(1-lamda)*A+lamda*B;
    plot(x(1,1),x(2,1),'b.', 'MarkerSize', 18)
        % plots one point
    pause(0.05);
    hold on
    axis('equal')
        % command to take equal distribution of points in X
        and Y axis
    plot([-1,5],[0,0]) % plots X axis
    plot([0,0],[-1,5]) % plots Y axis
    drawnow
end
```

The points on a line segment AB is:

$$\mathbf{x}=\{(1-\lambda)\mathbf{A}+ \lambda\mathbf{B}, 0 \leq \lambda \leq 1\}$$

➤ **Animate and plot 2 continuous line segments (Refraction with fixed interface point XE, starting point XO and endpoint XE)**

```
XO=[0;10];XM=[5;0];XE=[20;-5];
for lamda=0:0.05:1
    x=(1-lamda)*XO+lamda*XM;
    plot(x(1,1),x(2,1),'b.', 'MarkerSize', 18) % plots one point
    pause(0.05);
    hold on
    axis('equal') % command to take equal distribution of points
                    in X and Y axis
    plot([0,20],[0,0]) % plots X axis
    plot([0,0],[-5,10]) % plots Y axis
    drawnow
end
for lamda=0:0.05:1
    x=(1-lamda)*XM+lamda*XE;
    plot(x(1,1),x(2,1),'b.', 'MarkerSize', 18) % plots one point
    pause(0.05);
    hold on
    drawnow
end
```

Practise Questions

- Consider the curve C: $y = -\sin x$ in the interval $\left(0, \frac{\pi}{2}\right)$ Now using the respective matrices for rotation/reflection plot curves that gives:
 - rotation of the curve by 120 degrees
 - reflection of the curve about the Y axis
 - reflection of the curve along the $x=y$ line
 - reflection of the curve along the $y = -x$ line
 - rotation of the curve by 45 degrees in the clockwise direction.
 Plot all the above resultant curves manually as well as in MATLAB.
- Consider the semi-circle C: $(x-1)^2 + y^2 = 1$, above the X axis.
 - Plot the curve C.
 - What should be the matrix A used to rotate the curve C by 90 degrees to obtain curve C1. Also plot C1.
 - Now find the matrix B to reflect C1 about the X axis to get C2. Also plot C2.
 - What will be the matrix used to obtain C2 from C directly? Show plot of C and C2 in an other figure.

3. Write down the matrix :

(a) that is used to reflect a vector about the line $y=2x$

(b) that can rotate a vector by 60 degrees

(c) that can reflect a vector about about the line $y= - x$

Plot the curve $y=x^3$ in (0,2)

4. Show the animation of a line segment drawn from a point A(25,-10) to B(1,15).

5. Using animation try to plot the first letter of your name. (Select coordinates accordingly)